

EXHIBIT A



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[19]

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[54] **SYSTEM AND METHOD FOR SECURELY SYNCHRONIZING MULTIPLE COPIES OF A WORKSPACE ELEMENT IN A NETWORK**

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[51] **Int. Cl.**⁷ **G06F 17/30**

[52] **U.S. Cl.** **707/10; 707/203; 707/104; 707/1; 707/9; 707/10**

[58] **Field of Search** **707/203, 104, 707/1, 9, 10**

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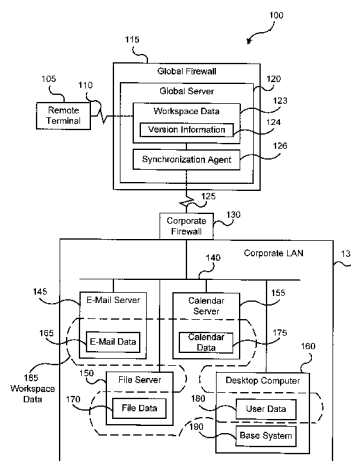
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[57]

ABSTRACT

A system includes a general synchronization module at the client site for operating within a first firewall and for examining first version information to determine whether a first workspace element has been modified. The system further includes a synchronization agent at a global server for operating outside the first firewall and for forwarding to the general synchronization module second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified. A synchronization-start module is maintained at the client site for operating within the first firewall and for securely initiating the general synchronization module and the synchronization agent when predetermined criteria have been satisfied. The system further includes means for generating a preferred version from the first workspace element and from the copy by comparing the first version information and the second version information, and means for storing the preferred version at the first store and at the second store.

25 Claims, 6 Drawing Sheets

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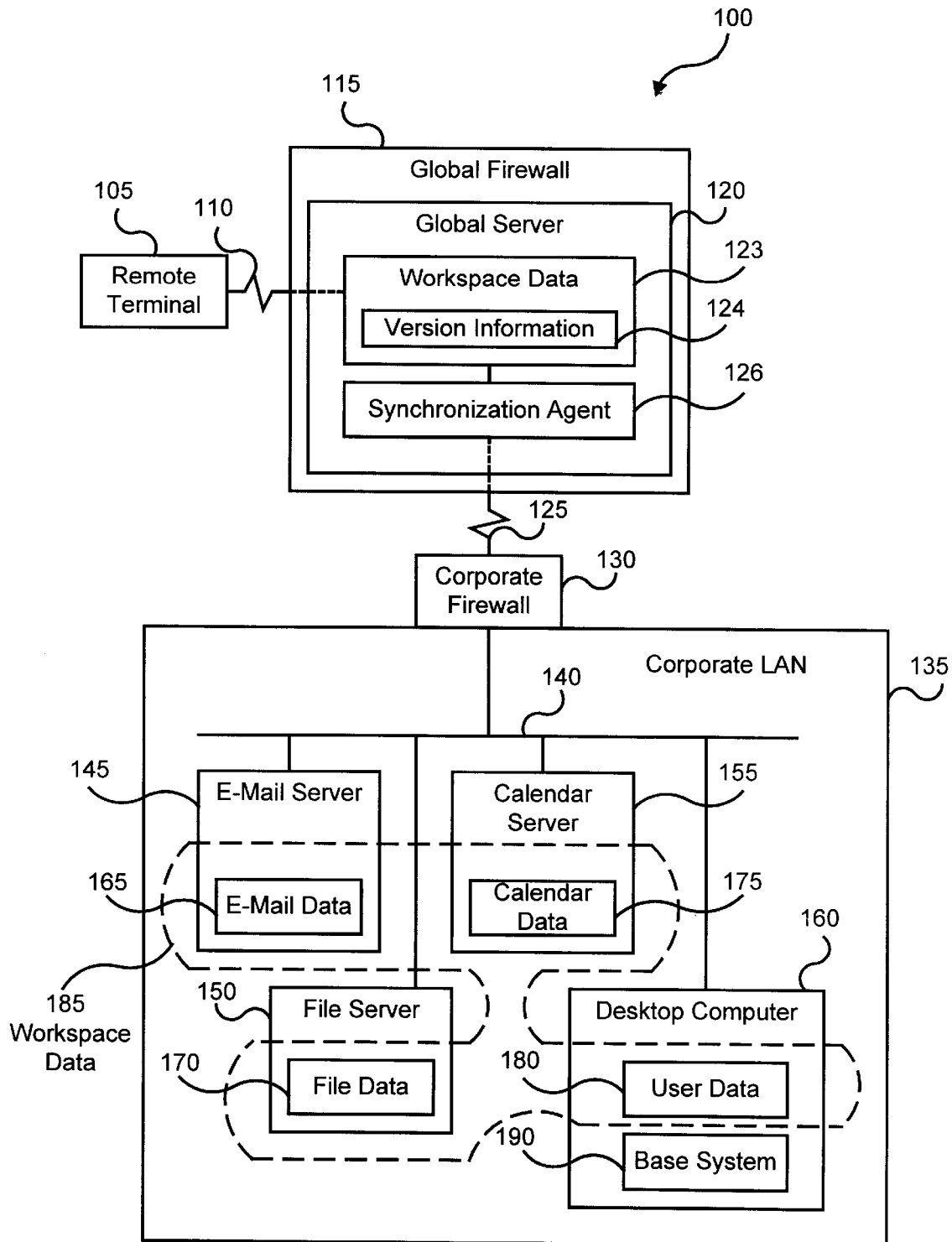


FIG. 1

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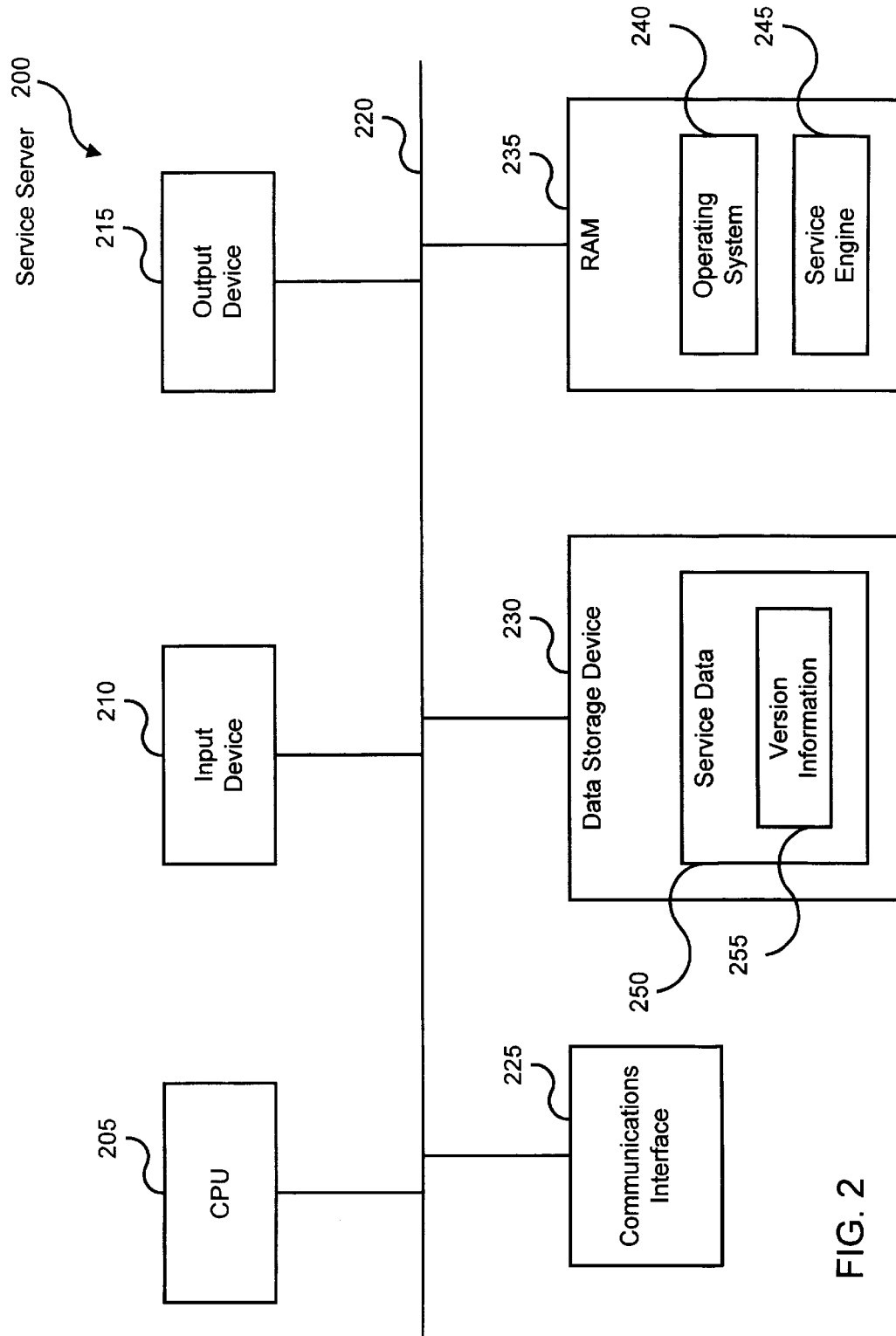


FIG. 2

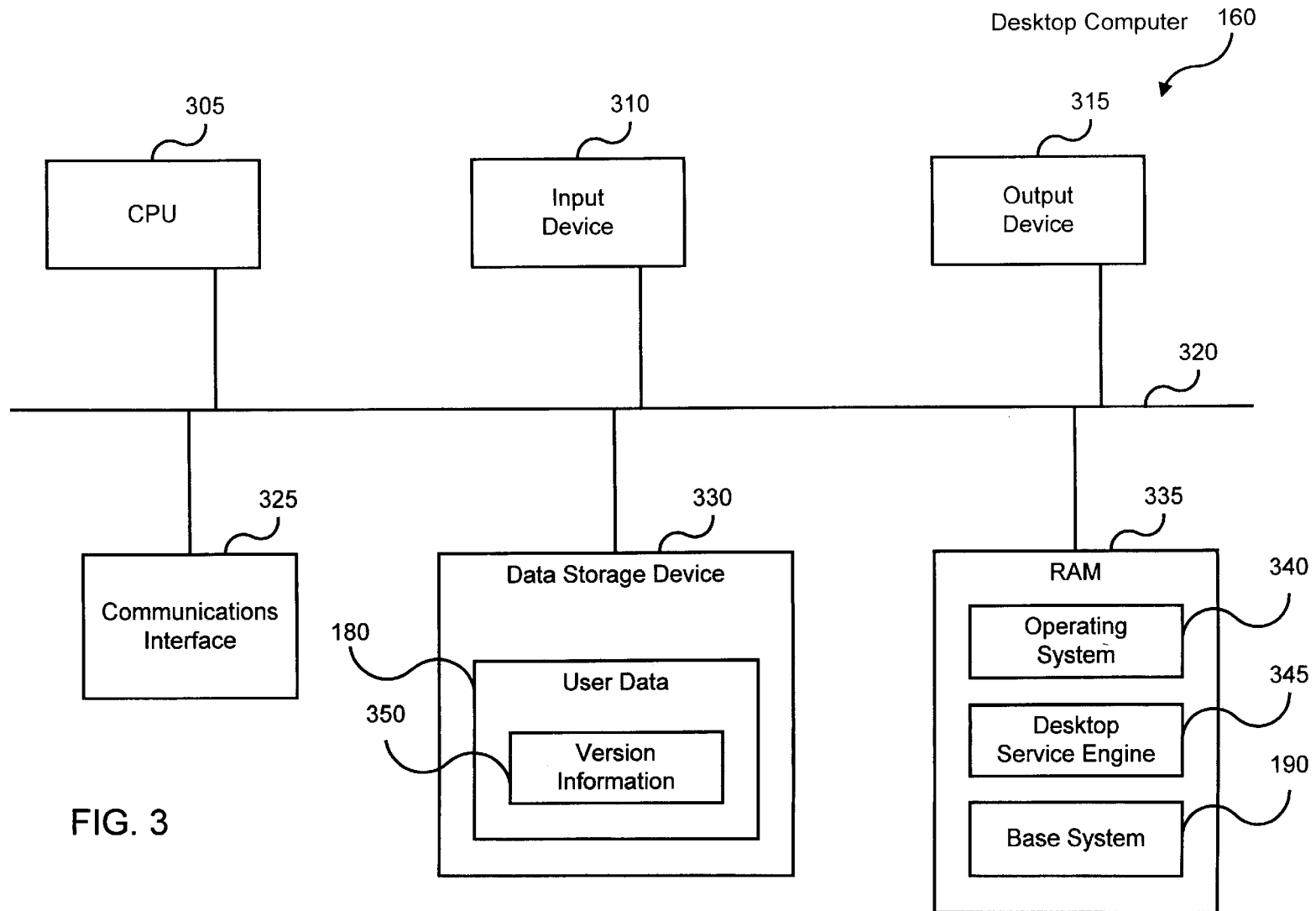


FIG. 3

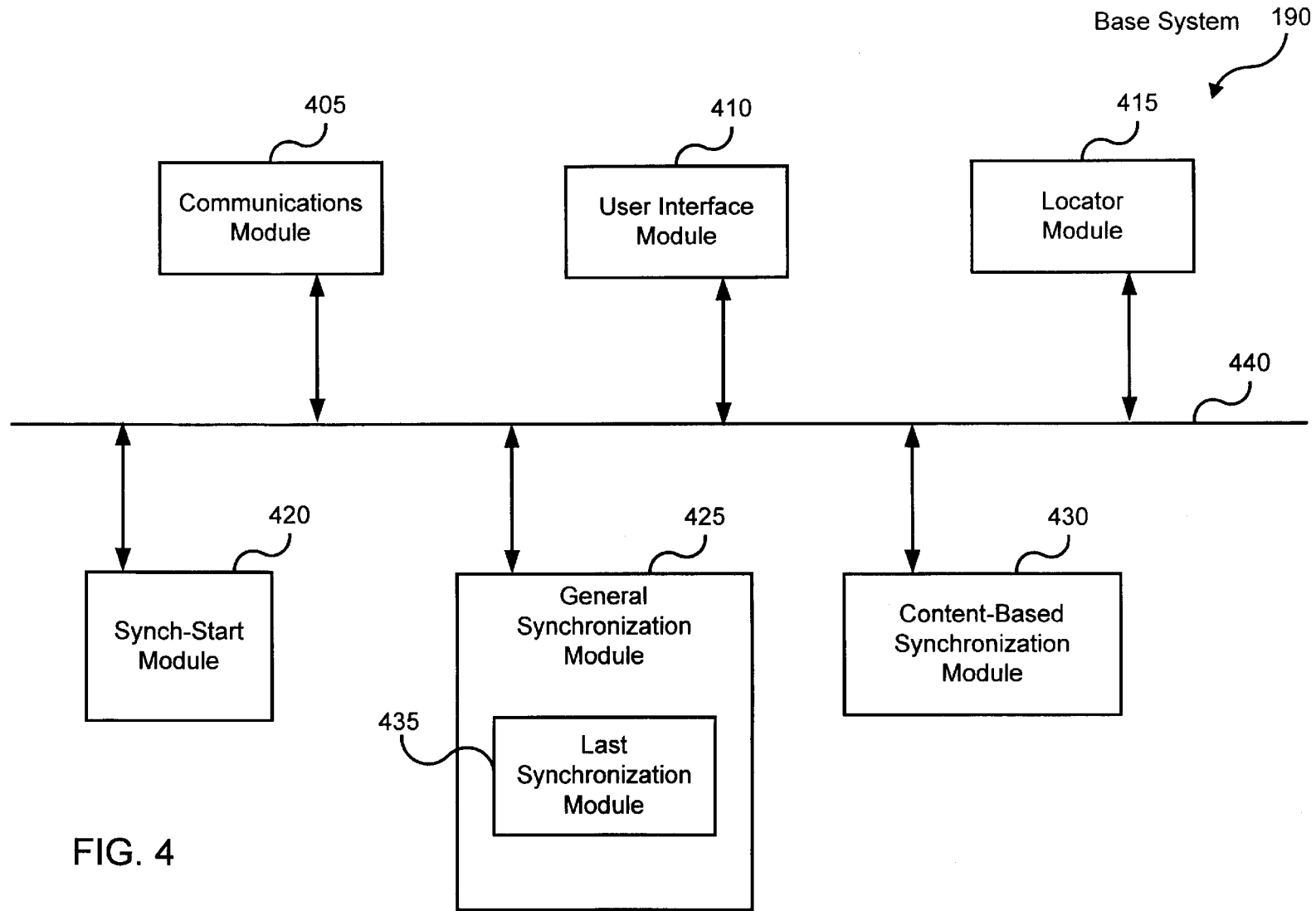


FIG. 4

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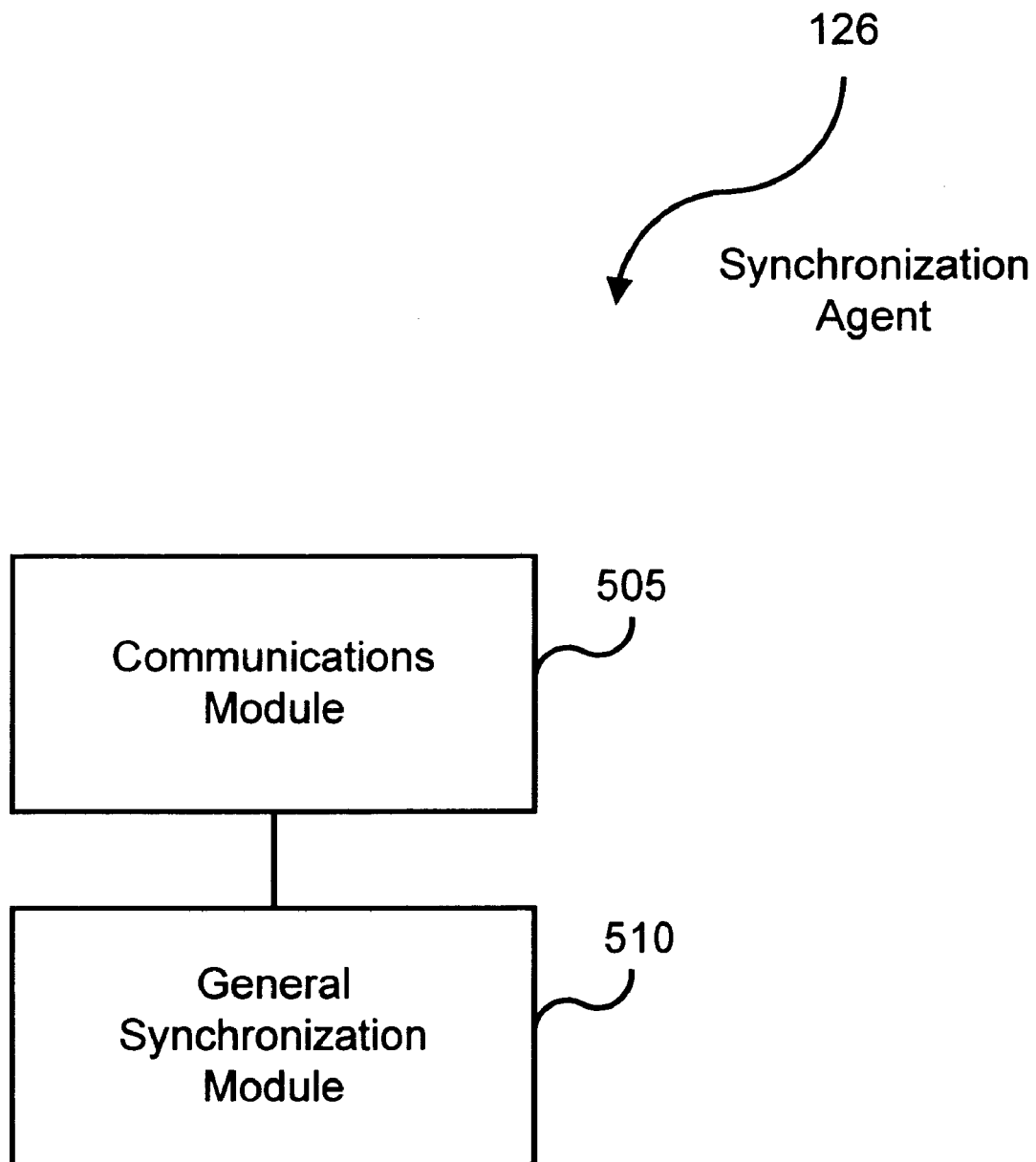


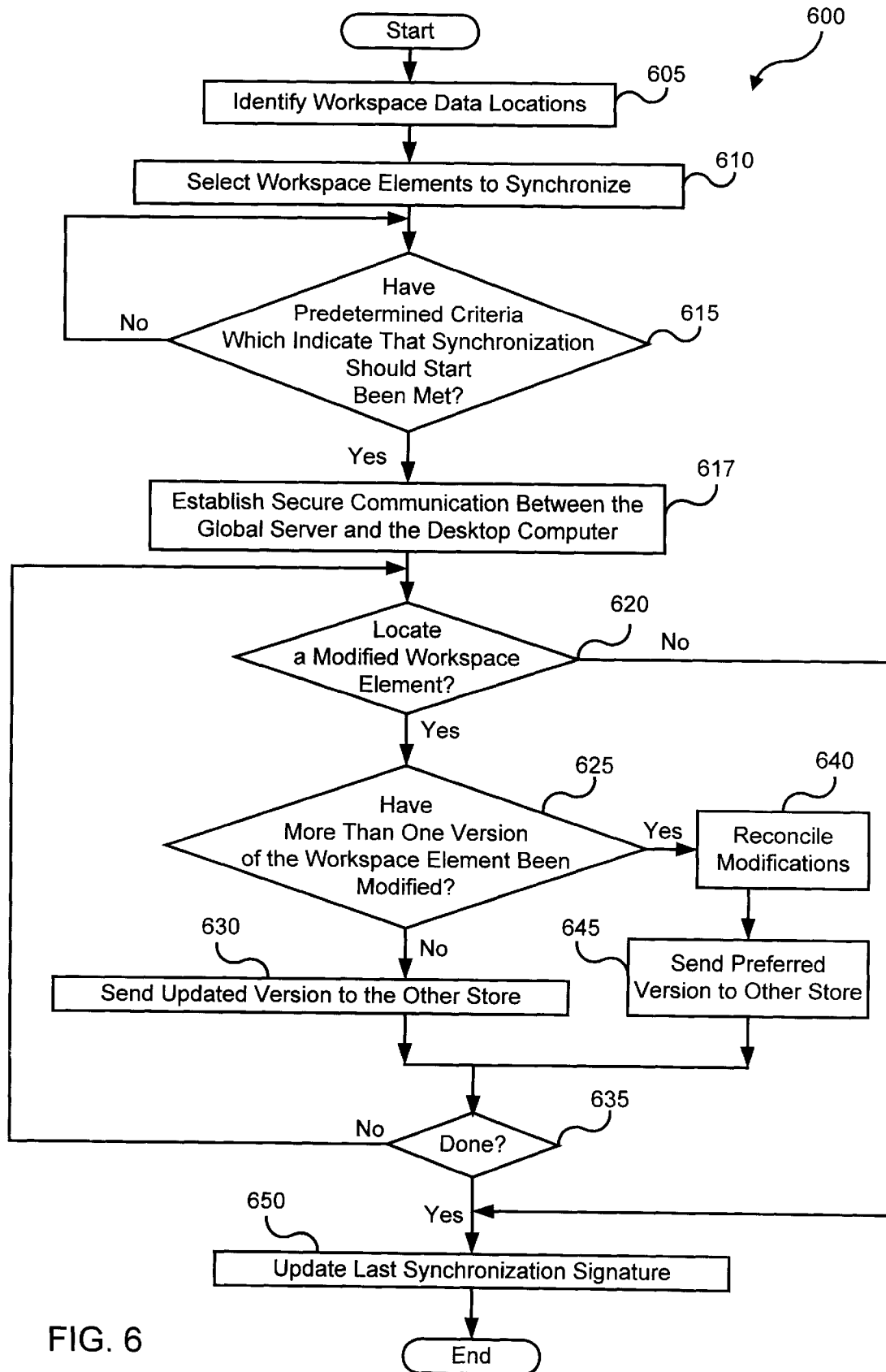
FIG. 5

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SYSTEM AND METHOD FOR SECURELY SYNCHRONIZING MULTIPLE COPIES OF A WORKSPACE ELEMENT IN A NETWORK

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is related to co-pending patent application entitled "System and Method for Globally Accessing Computer Services," Ser. No. 08/766,307, now pending, filed on Dec. 13, 1996, by inventors Mark D. Riggins, R. Stanley Bailes, Hong Q. Bui, David J. Cowan, Daniel J. Mendez, Mason Ng, Sean Michael Quinlan, Prasad Wagle, Christine C. Ying, Christopher R. Zuleeg and Joanna A. Aptekar-Strober; and to co-pending patent application entitled "System and Method for Enabling Secure Access to Services in a Computer Network," Ser. No. 08/841,950, now pending, filed on Apr. 8, 1997, by inventor Mark Riggins, both of which are hereby incorporated by reference. These related applications have been commonly assigned to RoamPage, Inc.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to computer networks, and more particularly to a system and method for securely synchronizing multiple copies of a workspace element such as a file in a secure network.

2. Description of the Background Art

Data consistency is a significant concern for computer users. For example, when maintaining multiple independently-modifiable copies of a document, a user risks using an outdated version. Further, by the time the user notices the inconsistency, interparty miscommunication or data loss may have resulted. The user must then spend more time attempting to reconcile the inconsistent versions.

The problem of data inconsistency is exacerbated when multiple copies of a document are maintained at different network locations. For example, due to network security systems such as conventional firewall technology, a user may have access only to a particular one of these network locations. Without access to the other sites, the user cannot confirm that the version on the accessible site is the most recent draft.

Therefore, a system and method are needed for providing users with data consistency, and more particularly for synchronizing multiple copies of a workspace element such as a document in the secure network environment.

SUMMARY OF THE INVENTION

The present invention provides a system and method for synchronizing multiple copies of a workspace element in a secure network environment. The secure network environment includes a global server connected to multiple clients. Using the present system and method, the clients automatically synchronize workspace data between multiple sites, independent of whether the sites are protected by site firewalls.

The present system includes a general synchronization module at the client site for operating within a first firewall and for examining first version information to determine whether a first workspace element has been modified. The system further includes a synchronization agent at the global server for operating outside the first firewall and for forwarding to the general synchronization module second version information which indicates whether an independently-

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modifiable copy of the first workspace element has been modified. A synchronization-start module, at the client site operates within the first firewall and initiates the general synchronization module and the synchronization agent when predetermined criteria have been satisfied. The system further includes means for generating a preferred version from the first workspace element and from the copy by comparing the first version information and the second version information, and means for storing the preferred version at the first store and at the second store.

The system further handles the case when both the workspace element and the copy have been modified independently since the last date and time of synchronization. Accordingly, a content-based synchronization module performs a responsive action such as determined a preferred version or storing both the first workspace element and the copy at both the first store and at the second store.

The present method includes the steps of generating first examination results by examining first version information, which indicates whether a first workspace element stored at a first store within a firewall has been modified; and generating second examination results by examining second version information which indicates whether an independently-modifiable copy of the first workspace element, the copy being stored at a second store outside the firewall, has been modified. The present method further includes the steps of initiating synchronization from within the firewall when predetermined criteria have been satisfied; generating a preferred version from the first workspace element and from the copy based on the first and second examination results; and storing the preferred version at the first store and at the second store.

The system and method advantageously use a trusted third party to enable the synchronization of workspace data among multiple sites. Accordingly, a client user who maintains a work site, a home site, an off-site and the global server site can synchronize the workspace data or portions thereof among all four sites. Further, the predetermined criteria (which controls when the synchronizationstart module initiates synchronization) may be set so that the general synchronization module synchronizes the workspace data upon user request, at predetermined times during the day such as while the user is commuting, or after a predetermined user action such as user log-off or user log-on. Because the system and method operate over the Internet, synchronization can occur over any distance. Since synchronization is initiated from within the firewall, the typical firewall, which prevents in-bound communications, does not act as an impediment to workspace data synchronization. Also, since the user's preferences may be previously set, the present system and method may operate unattended by the client user.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram illustrating a secure data-synchronizing network in accordance with the present invention;

FIG. 2 is a block diagram illustrating details of a FIG. 1 service server;

FIG. 3 is a block diagram illustrating details of the FIG. 1 desktop computer;

FIG. 4 is a block diagram illustrating details of the FIG. 3 base system;

FIG. 5 is a block diagram illustrating details of the FIG. 1 synchronization agent; and

FIG. 6 is a flowchart illustrating a method for synchronizing multiple copies of a workspace element in a secure network.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 is a block diagram illustrating a secure data-synchronizing network **100**, comprising a first site such as a remote computer terminal **105** coupled via a communications channel **110** such as the Internet to a global server **120**. The global server **120** is in turn coupled via a communications channel **125** such as the Internet to a second site such as a corporate Local Area Network (LAN) **135**. The global server **120** is protected by a global firewall **115**, and the corporate LAN **135** is protected by a corporate firewall **130**.

The corporate LAN **135** includes a corporate signal bus **140** coupling the corporate firewall **130** to an e-mail server **145** having e-mail data **165**, to a file server **150** having file data **170**, to a calendar server **155** having calendar data **175** and to a desktop computer **160** having user data **180**. It will be appreciated that the e-mail data **165**, file data **170**, calendar data **175** and user data **180** or portions thereof may be stored at different locations such as locally on the desktop computer **160**. It will be further appreciated that the e-mail data **165**, file data **170**, calendar data **175** and user data **180** are exemplary and collectively referred to herein as "workspace data" **185**. Those skilled in the art will recognize that "workspace data" may include other types of data such as application programs. It will be further appreciated that the e-mail data **165**, file data **170**, calendar data **175** and user data **180** may each be divided into workspace elements, wherein each workspace element is identified by particular version information **255** (described below with reference to FIG. 2). Accordingly, each e-mail, file, calendar, etc. may be referred to as "a workspace element in workspace data."

An independently modifiable copy of the workspace data **185**, referred to herein as workspace data **123**, is stored on the global server **120** for easy access by a user from the remote terminal **105**. Being a copy, the workspace data **123** includes independently modifiable copies of each workspace element in workspace data **185** and an independently modifiable copy of version information **255** (FIG. 2), referred to herein as version information **124**.

Network **100** further comprises synchronization means, which includes a base system **190** stored within the corporate LAN **135** and for example on the desktop computer **160** and further includes a synchronization agent **126** stored outside the corporate firewall **130** and preferably on the global server **120**. The base system **190** and the synchronization agent **126** cooperate to synchronize the workspace data **185** with the workspace data **123**. Generally, the base system **190** manages the workspace data **185** within the corporate LAN **135** and the synchronization agent **126** manages the workspace data **123** within the global server **120**. As described in greater detail below with reference to FIG. 4, the base system **190** preferably initiates and controls data synchronization. Other components and functions of the global server **120** are described in the cross-referenced patent applications which are herein incorporated by reference.

The remote terminal **105** may include a smart telephone or a Personal Data Assistant (PDA) such as the PalmPilot system by the U.S. Robotics, Inc. Although not shown, the remote terminal **105** may include a second base system similar to the base system **190**, which is described with greater detail with reference to FIG. 4. Accordingly, the second base system on the remote terminal **105** would cooperate with the synchronization agent **126** to synchronize the workspace data stored on the remote terminal **105** with the workspace data **123** stored on the global server **120**. As

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with the corporate LAN, the second base system on the remote terminal **105** would preferably initiate and control data synchronization with the global server **120** for the same reasons discussed below. Workspace data on the remote terminal **105** would thus be synchronized with the workspace data **123** and with the workspace data **185**.

FIG. 2 is a block diagram illustrating details of a service server **200**, wherein each of the e-mail server **145**, the file server **150**, the calendar server **155** and the desktop computer **160** is an instance thereof. Service server **200** includes a Central Processing Unit (CPU) **205** such as a Motorola Power PC® microprocessor or an Intel Pentium® microprocessor. An input device **210** such as a keyboard and mouse and an output device **215** such as a Cathode Ray Tube (CRT) display are coupled via a signal bus **220** to CPU **205**. A communications interface **225** (such as an Ethernet port), a data storage device **230** (such as read only memory or a magnetic disk), and Random-Access Memory (RAM) **235** are further coupled via signal bus **220** to the CPU **205**.

An operating system **240** includes a program for controlling processing by the CPU **205**, and is typically stored in the data storage device **230** and loaded into the RAM **235** for execution. A service engine **245** includes a program for performing a particular service such as maintaining an e-mail data base, a calendar data base, a bookmarks data base or another file data base, and may be also stored in the data storage device **230** and loaded into the RAM **235** for execution. To perform a service, the service engine **245** operates on service data **250** (e.g., the e-mail data **165**, the file data **170**, the calendar data **175** or the user data **180**), which is typically stored in the data storage device **250**. The service data **250** includes version information **255** indicating the date and time of the last modification. The service engine **245** operates to update the version information **255** whenever modifications are made. It will be appreciated that the portion of memory in the data storage device **250** which contains the service data **250** is referred to as the service "store."

FIG. 3 is a block diagram illustrating details of the desktop computer **160**, which includes a CPU **305**, an input device **310**, an output device **315**, a communications interface **325**, a data storage device **330** and RAM **335**, each coupled to a signal bus **320**.

An operating system **340** includes a program for controlling processing by the CPU **305**, and is typically stored in the data storage device **330** and loaded into the RAM **335** for execution. A desktop service engine **345** (i.e., a particular service engine **245**, FIG. 2) includes a service program for managing user data **180** (i.e., particular service data **250**, FIG. 2) which includes version information **255**, FIG. 2). The desktop service engine **345** may be also stored in the data storage device **330** and loaded into the RAM **335** for execution. The user data **180** may be stored in the data storage device **330**. As stated above with reference to FIG. 1, the base system **190** operates to synchronize the workspace data **185** (which includes user data **180**) with the workspace data **123**. The base system **190** may be also stored in the data storage device **330** and loaded into the RAM **335** for execution.

FIG. 4 is a block diagram illustrating details of the base system **190**, which includes a communications module **405**, a user interface module **410**, a locator module **415**, a synchronization-start ("synch-start") module **420**, a general synchronization module **425** and a content-based synchronization module **430**. For simplicity, each module is illustrated as communicating with one another via a signal bus **440**.

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The communications module **405** includes routines for compressing data, and routines for communicating via the communications interface **325** (FIG. **3**) with the synchronization agent **126** (FIG. **1**). The communications module **405** may further include routines for applying Secure Socket Layer (SSL) technology and user identification and authentication techniques (i.e., digital certificates) to establish a secure communication channel through the corporate firewall **130** and through the global firewall **126**. Examples of communications modules **405** may include TCP/IP stacks or the AppleTalk® protocol.

The user interface **410** includes routines for communicating with a user, and may include a conventional Graphical User Interface (GUI). The user interface **410** operates in coordination with the other desktop computer **160** components as described herein.

The locator module **415** includes routines for identifying the memory locations of the workspace elements in the workspace data **185** and the memory locations of the workspace elements in the workspace data **123**. Workspace element memory location identification may be implemented using intelligent software, i.e., preset memory addresses or the system's registry, or using dialogue boxes to query a user. Accordingly, the locator module **415** determines the memory addresses of the workspace elements in the e-mail data **165**, the workspace elements in the file data **170**, the workspace elements in the calendar data **175** and the workspace elements in the user data **180** as well as the memory addresses of the corresponding workspace elements in the workspace data **123**. It will be appreciated that the locator module **415** may perform workspace element memory location identification upon system boot-up or after each communication with the global server **120** to maintain updated memory locations of workspace elements.

The synchronization-start module **420** includes routines for determining when to initiate synchronization of workspace data **123** and workspace data **185**. For example, the synchronization-start module **420** may initiate data synchronization upon user request, at a particular time of day, after a predetermined time period passes, after a predetermined number of changes, after a user action such as user log-off or upon like criteria. The synchronization-start module **420** initiates data synchronization by instructing the general synchronization module **425** to begin execution of its routines. It will be appreciated that communications with synchronization agent **126** preferably initiate from within the corporate LAN **1135**, because the typical corporate firewall **130** prevents in-bound communications and allows out-bound communications.

The general synchronization module **425** includes routines for requesting version information **124** from the synchronization agent **126** (FIG. **1**) and routines for comparing the version information **255** against a last synchronization signature **435** such as a last synchronization date and time to determine which versions have been modified. The general synchronization module **425** further includes routines for comparing the version information **124** and the version information **255** to determine if only one or both versions of a particular workspace element have been modified and routines for performing an appropriate synchronizing responsive action. Appropriate synchronizing responsive actions may include forwarding the modified version (as the preferred version) of a workspace element in workspace data **185** or forwarding just a compilation of the changes to the other store(s). Other appropriate synchronizing responsive actions may include, if reconciliation between two modified versions is needed, then instructing the content-based syn-

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chronization module **430** to execute its routines which are described below.

It will be appreciated that the synchronization agent **126** preferably examines the version information **124** and forwards only the version information **124** determined to be modified since the last synchronization signature **435**. This technique makes efficient use of processor power and avoids transferring unnecessary data across the communications channel **125**. The general synchronization module **425** in the corporate LAN **135** accordingly compares the received version information **124** with the version information **255** to determine if reconciliation is needed. Upon completion of the data synchronization, the general synchronization module **425** updates the last synchronization signature **435**.

The content-based synchronization module **430** includes routines for reconciling two or more modified versions in workspace data **123**, **185** of the same workspace element. For example, if the original and the copy of a user workspace element have both been modified independently since the last synchronization, the contentbased synchronization module **430** determines the appropriate responsive action. The content-based synchronization module **430** may request a user to select the preferred one of the modified versions or may respond based on preset preferences, i.e., by storing both versions in both stores or by integrating the changes into a single preferred version which replaces each modified version at both stores.

FIG. **5** is a block diagram illustrating details of the synchronization agent **126**, which includes a communications module **505** (similar to the communications module **405** described above with reference to FIG. **4**) and a general synchronization module **510** (similar to the general synchronization module **425** described above also with reference to FIG. **4**). The communications module **505** includes routines for compressing data, and routines for communicating via the communications channel **125** with the base system **190**. The communications module **505** may further include routines for establishing a secure communications channel through the global firewall **126** and through the corporate firewall **130**.

The general synchronization module **510** includes routines for comparing the version information **124** with the last synchronization signature **435**, and routines for forwarding to the general synchronization module **425** version information **124** determined to be modified. The general synchronization module **510** may either maintain its own last synchronization signature **435** copy (not shown). Alternatively, the request to synchronize from the base system **190** may include a copy of the last synchronization signature **435**. The general synchronization module **510** further includes routines for receiving preferred versions of workspace data **185** workspace elements from the general synchronization module **425**, and routines for forwarding preferred versions of workspace data **123** workspace elements to the general synchronization module **425**.

FIG. **6** is a flowchart illustrating a method **600** for synchronizing multiple copies of workspace data **123**, **185** in a secure network **100**. Method **600** begins with locator module **415** in step **605** identifying the memory locations of the workspace elements in workspace data **123**, **185**. As stated above, workspace element memory location identification may be implemented using intelligent software or dialogue boxes. The user interface module **410** in step **610** enables selection of the workspace elements in workspace data **123**, **185** to be synchronized by the general synchronization module **425**.

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The synchronization-start module **420** in step **615** determines whether predetermined criteria have been met which indicate that synchronization of the workspace elements selected in step **610** should start. If not, then method **600** loops back to step **615**. Otherwise, the communications module **405** and communications module **505** in step **617** establish a secure communications channel between the global server **120** and the desktop computer **160**. The general synchronization module **510** in step **620** compares the version information **124** of each of the selected workspace elements in workspace data **123** against the last synchronization signature **435** to determine modified workspace elements, and forwards the version information **124** of workspace elements determined to be modified to the general synchronization module **425**. Further, the general synchronization module **425** in step **620** compares the version information **255** of each selected workspace element in the workspace data **185** against the last synchronization signature **435** to locate modified workspace elements. In this embodiment, a workspace element has been modified if the date and time of last modification is after the date and time of last synchronization.

If no modified workspace elements in workspace data **123** or in workspace data **185** are located, then the general synchronization modules **425** and **510** in step **650** update the last synchronization signature **435** and method **600** ends. Otherwise, the general synchronization module **425** in step **625** determines whether more than one version of the same workspace element has been modified since the last synchronization.

If only one version has been modified, then the corresponding general synchronization module **425** or **510** in step **630** forwards the updated preferred version of the workspace element to the other store, and then in step **635** determines whether all workspace elements selected in step **610** have been examined. If so, then method **600** jumps to step **650**. Otherwise, then method **600** returns to step **620**.

If more than one version has been modified, then the general synchronization module **425** in step **640** instructs the content-based synchronization module **430** to reconcile the modified versions. Reconciliation may include requesting instructions from the user or, based on preselected preferences, performing responsive actions such as storing both versions at both stores.

General synchronization module **425**, **510** in step **645** sends the preferred version of the workspace element or just a compilation of the changes to the other store. That is, if the preferred version is a workspace element in the workspace data **185**, then general synchronization module **425** sends the preferred version or the changes to general synchronization module **510** to update the outdated workspace element in the workspace data **123**. If the preferred version is a workspace element in the workspace data **123**, then the general synchronization module **510** sends the preferred version or the changes to the general synchronization module **425** to update the outdated workspace element in the workspace data **185**. Method **600** then jumps to step **635**.

The foregoing description of the preferred embodiments of the invention is by way of example only, and other variations of the above-described embodiments and methods are provided by the present invention. For example, although the global server **120** is illustrated as a single device, the global server **120** may include several computers networked together. Although not described in great detail, the remote terminal **105** can synchronize copies of workspace elements stored on it with workspace elements of

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workspace data **123** stored on the global server **120**. Components of this invention may be implemented using a programmed general purpose digital computer, using application specific integrated circuits, or using a network of interconnected conventional components and circuits. The embodiments described herein have been presented for purposes of illustration and are not intended to be exhaustive or limiting. Many variations and modifications are possible in light of the foregoing teaching. The system is limited only by the following claims.

What is claimed is:

1. A computer-based method comprising the steps of:

- (a) generating first examination results from first version information which indicates whether a first workspace element stored at a first store within a firewall has been modified;
- (b) generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store outside the firewall;
- (c) initiating steps (a) and (b) from within the firewall when predetermined criteria have been satisfied;
- (d) generating a preferred version from the first workspace element and from the copy based on the first and second examination results; and
- (e) storing the preferred version at the first store and at the second store.

2. The method of claim 1 wherein the second store is on a global server outside the firewall and which is protected by a global firewall.

3. The method of claim 1 wherein the first version information includes the date and time the first workspace element was last modified and the second version information includes the date and time the copy was last modified.

4. The method of claim 3 wherein generating the first examination results includes the step of comparing the first version information against a date and time of last synchronization.

5. The method of claim 3 wherein generating the second examination results includes the step of comparing the second version information against a date and time of last synchronization.

6. The method of claim 1 further comprising, before generating the first examination results, the step of updating the first version information whenever the first workspace element is modified.

7. The method of claim 1 further comprising, before generating the second examination results, the step of updating the second version information whenever the copy is modified.

8. The method of claim 1 wherein if only one of the first workspace element and the copy has been modified, then the step of generating includes selecting the one as the preferred version.

9. The method of claim 1 further comprising the step of locating the first workspace element, the first version information, the copy and the second version information.

10. A system comprising:

a general synchronization module for operating within a first firewall and for examining first version information to determine whether a first workspace element has been modified;

a synchronization agent for operating outside the first firewall and for forwarding to the general synchronization module second version information which indi-

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cates whether an independently modifiable copy of the first workspace element has been modified;

a synchronization-start module for operating within the first firewall and for initiating the general synchroni- 5
zation module and the synchronization agent when predetermined criteria have been satisfied;

means for generating a preferred version from the first workspace element and from the copy by comparing the first version information and the second version information; and 10

means for storing the preferred version at the first store and at the second store.

11. The system of claim 10 further comprising a communications module for communicating through the first firewall. 15

12. The system of claim 10 wherein the synchronization agent and the second store are on a global server which is protected by a global firewall.

13. The system of claim 12 further comprising a communications module for communicating through the first firewall and through the global firewall. 20

14. The system of claim 10 wherein the first version information includes the date and time the first workspace element was last modified and the second version information includes the date and time the copy was last modified. 25

15. The system of claim 14 wherein the general synchronization module compares the first version information against a date and time of last synchronization.

16. The system of claim 14 wherein the synchronization agent compares the second version information against the date and time of last synchronization. 30

17. The system of claim 10 further comprising means for updating the first version information whenever the first workspace element is modified.

18. The system of claim 10 further comprising means for updating the second version information whenever the copy is modified. 35

19. The system of claim 10 wherein if only one of the first workspace element and the copy has been modified, then the means for generating selects the one as the preferred version.

20. The system of claim 10 further comprising a locator module for locating the first store, the first workspace element, the first version information, the second store, the copy and the second version information. 40

21. A system comprising:

first means for generating first examination results from first version information which indicates whether a first workspace element stored at a first store within a firewall has been modified; 45

second means for generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store outside the firewall; 50

means for initiating the first and second means from within the firewall when predetermined criteria have been satisfied; 55

means for generating a preferred version from the first workspace element and from the copy based on the first and second examination results; and

means for storing the preferred version at the first store and at the second store. 60

22. A computer-readable storage medium storing program code for causing a computer to perform the steps of:

(a) generating first examination results from first version information which indicates whether a first workspace element stored at a first store within a firewall has been modified; 65

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(b) generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store outside the firewall;

(c) initiating steps (a) and (b) from within the firewall when predetermined criteria have been satisfied;

(d) generating a preferred version from the first workspace element and from the copy based on the first and second examination results; and

(e) storing the preferred version at the first store and at the second store.

23. A computer-based method comprising the steps of:

(a) generating first examination results from first version information which indicates whether a first workspace element stored at a first store within a firewall has been modified;

(b) generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store outside the firewall;

(c) initiating steps (a) and (b) from within the firewall when predetermined criteria have been satisfied;

(d) determining based on the first and second examination results that both the first workspace element and the copy have been modified; and

(e) storing both the first workspace element and the copy at the first store and at the second store.

24. A system comprising:

first means for generating first examination results from first version information which indicates whether a first workspace element stored at a first store within a firewall has been modified;

second means for generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store outside the firewall;

means for initiating the first and second means from within the firewall when predetermined criteria have been satisfied;

means for determining based on the first and second examination results that both the first workspace element and the copy have been modified; and

means for storing both the first file and the copy at the first store and at the second store.

25. A system comprising:

a global server for operating outside a firewall and including memory for storing first workspace data and corresponding first version information; and

a synchronization agent for managing the first workspace data and the corresponding first version information and for communicating with remote clients; and

a remote client for operating within the firewall and including memory for storing second workspace data and corresponding second version information;

means for cooperating with the synchronization agent to synchronize the first workspace data with the second workspace data by examining the first version information and the second version information; and

a synchronization-start module for initiating workspace data synchronization between the global server and the remote client.

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(12) **EX PARTE REEXAMINATION CERTIFICATE** (5234th)
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(54) **SYSTEM AND METHOD FOR SECURELY SYNCHRONIZING MULTIPLE COPIES OF A WORKSPACE ELEMENT IN A NETWORK**

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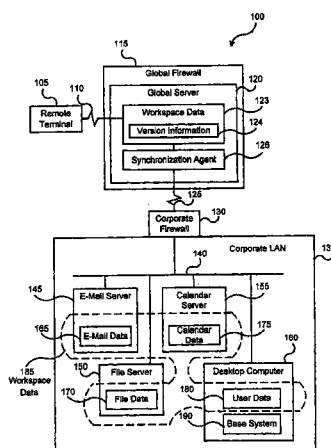
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(57) ABSTRACT

A system includes a general synchronization module at the client site for operating within a first firewall and for examining first version information to determine whether a first workspace element has been modified. The system further includes a synchronization agent at a global server for operating outside the first firewall and for forwarding to the general synchronization module second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified. A synchronization-start module is maintained at the client site for operating within the first firewall and for securely initiating the general synchronization module and the synchronization agent when predetermined criteria have been satisfied. The system further includes means for generating a preferred version from the first workspace element and from the copy by comparing the first version information and the second version information, and means for storing the preferred version at the first store and at the second store.



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EX PARTE
REEXAMINATION CERTIFICATE
ISSUED UNDER 35 U.S.C. 307

THE PATENT IS HEREBY AMENDED AS
INDICATED BELOW.

Matter enclosed in heavy brackets [] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

ONLY THOSE PARAGRAPHS OF THE
SPECIFICATION AFFECTED BY AMENDMENT
ARE PRINTED HEREIN.

Column 4, lines 20–38:

An operating system **240** includes a program for controlling processing by the CPU **205**, and is typically stored in the data storage device **230** and loaded into the RAM **235** for execution. A service engine **245** includes a program for performing a particular service such as maintaining an e-mail data base, a calendar data base, a bookmarks data base or another file data base, and may be also stored in the data storage device **230** and loaded into the RAM **235** for execution. To perform a service, the service engine **245** operates on service data **250** (e.g., the e-mail data **165**, the file data **170**, the calendar data **175** or the user data **180**), which is typically stored in the data storage device **[250]** **230**. The service data **250** includes version information **255** indicating the date and time of the last modification. The service engine **245** operates to update the version information **255** whenever modifications are made. It will be appreciated that the portion of memory in the data storage device **[250]** **230** which contains the service data **250** is referred to as the service “store.”

Column 4, lines 44–59:

An operating system **340** includes a program for controlling processing by the CPU **305**, and is typically stored in the data storage device **330** and loaded into the RAM **335** for execution. A desktop service engine **345** (i.e., a particular service engine **245**, FIG. 2) includes a service program for managing user data **180** (i.e., particular service data **250**, FIG. 2) which includes version information **350** (i.e., particular version information **255**, FIG. 2). The desktop service engine **345** may be also stored in the data storage device **330** and loaded into the RAM **335** for execution. The user data **180** may be stored in the data storage **330**. As stated above with reference to FIG. 1, the base system **[1 90]** **190** operates to synchronize the workspace data **185** (which includes user data **180**) with the workspace data **123**. The base system **190** may be also stored in the data storage device **330** and loaded into the RAM **335** for execution.

Column 5, lines 35–49:

The synchronization-start module **420** includes routines for determining when to initiate synchronization of workspace data **123** and workspace data **185**. For example, the synchronization-start module **420** may initiate data synchronization upon user request, at a particular time of day, after a predetermined time period passes, after a predetermined number of changes, after a user action such as user log-off or upon like criteria. The synchronization-start module **420** initiates data synchronization by instructing the general synchronization module **425** to begin execution of its routines. It will be appreciated that communications with synchronization agent **126** preferably initiate from within the

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cooperate LAN **[1135]** **135**, because the typical cooperate firewall **130** prevents in-bound communications and allows out-bound communications.

Column 6, lines 15–27:

The content-based synchronization module **430** includes routines for reconciling two or more modified versions in workspace data **123**, **185** of the same workspace element. For example, if the original and the copy of a user workspace element have both been modified independently since the last synchronization, the **[contentbased]** *content-based* synchronization module **430** determines the appropriate responsive action. The content-based synchronization module **430** may request a user to select the preferred one of the modified versions or may respond based on preset preferences, i.e., by storing both versions in both stores or by integrating the changes into a single preferred version which replaces each modified version at both stores.

Column 6, lines 28–41:

FIG. 5 is a block diagram illustrating details of the synchronization agent **126**, which includes a communications module **505** (similar to the communications module **405** described above with reference to FIG. 4) and a general synchronization module **510** (similar to the general synchronization module **425** described above also with reference to FIG. 4). The communications module **505** includes routines for compressing data, and routines for communicating via the communications channel **125** with the base system **190**. The communications module **505** may further include routines for establishing a secure communications channel through the global firewall **[126]** **115** and through the corporate firewall **130**.

Column 6, lines 42–56:

The general synchronization module **510** includes routines for comparing the version information **124** with the last synchronization signature **435**, and routines for forwarding to the general synchronization module **425** version information **124** determined to be modified. The general synchronization module **510** may **[either]** maintain its own last synchronization signature **435** copy (not shown). Alternatively, the request to synchronize from the base system **190** may include a copy of the last synchronization signature **435**. The general synchronization module **510** further includes routines for receiving preferred versions of workspace data **185** workspace elements from the general synchronization module **425**, and routines for forwarding preferred versions of workspace data **123** workspace elements to the general synchronization module **425**.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

Claim **19** is cancelled.

Claims **1–2**, **6–8**, **10–11** and **21–25** are determined to be patentable as amended.

Claims **3–5**, **9**, **12–18** and **20**, dependent on an amended claim, are determined to be patentable.

1. A computer-based method comprising the steps of:

(a) *establishing a communications channel through a firewall using an HTTP port or an SSL port;*

(b) generating first examination results from first version information which indicates whether a first workspace element stored at a first store within **[a]** the firewall has been modified;

(b)c) generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store *on a smart phone* outside the firewall;

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([c]d) initiating steps ([a]b) and ([b]c) from within the firewall through the communications channel when predetermined criteria have been satisfied;

([d]e) generating a preferred version from the first workspace element and from the copy based on the first and second examination results, wherein if only one of the first workspace element and the copy has been modified, then the step of generating includes selecting the one as the preferred version; and

([e]f) storing the preferred version at the first store and at the second store.

2. [The method of claim 1] A computer-based method comprising the steps of:

(a) generating first examination results from first version information which indicates whether a first workspace element stored at a first store within a firewall has been modified;

(b) generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store outside the firewall;

(c) initiating steps (a) and (b) from within the firewall when predetermined criteria have been satisfied;

(d) generating a preferred version from the first workspace element and from the copy based on the first and second examination results; and

(e) storing the preferred version at the first store and at the second store;

wherein the second store is on a global server outside the firewall and which is protected by a global firewall.

6. [The method of claim 1 further comprising,] A computer-based method comprising the steps of:

(a) generating first examination results from first version information which indicates whether a first workspace element stored at a first store within a firewall has been modified;

(b) generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store outside the firewall;

(c) initiating steps (a) and (b) from within the firewall when predetermined criteria have been satisfied;

(d) generating a preferred version from the first workspace element and from the copy based on the first and second examination results;

(e) storing the preferred version at the first store and at the second store; and

before generating the first examination results, the step of updating the first version information whenever the first workspace element is modified.

7. [The method of claim 1 further comprising,] A computer based method comprising the steps of:

(a) generating first examination results from first version information which indicates whether a first workspace element stored at a first store within a firewall has been modified;

(b) generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store outside the firewall;

(c) initiating steps (a) and (b) from within the firewall when predetermined criteria have been satisfied;

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(d) generating a preferred version from the first workspace element and from the copy based on the first and second examination results;

(e) storing the preferred version at the first store and at the second store; and

before generating the second examination results, the step of updating the second version information whenever the copy is modified.

8. [The method of claim 1] A computer-based method comprising the steps of:

(a) generating first examination results from first version information which indicates whether a first workspace element stored at a first store within a firewall has been modified;

(b) generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store outside the firewall;

(c) initiating steps (a) and (b) from within the firewall when predetermined criteria have been satisfied;

(d) generating a preferred version from the first workspace element and from the copy based on the first and second examination results;

(e) storing the preferred version at the first store and at the second store; and

wherein if only one of the first workspace element and the copy has been modified, then the step of generating includes selecting the one as the preferred version.

10. A system comprising:

a communications channel through a firewall comprising one of an HTTP port and an SSL port;

a general synchronization module for operating within [a] the first firewall and for examining first version information to determine whether a first workspace element at a first store has been modified;

a synchronization agent for operating outside the first firewall and for forwarding to the general synchronization module second version information which indicates whether an independently modifiable copy of the first workspace element at a second store on a smart phone has been modified;

a synchronization-start module for operating within the first firewall and for initiating the general synchronization module and the synchronization agent when predetermined criteria have been satisfied;

means for generating a preferred version from the first workspace element and from the copy by comparing the first version information and the second version information, wherein if only one of the first workspace element and the copy has been modified, then the means for generating selects the one as the preferred version; and

means for storing the preferred version at the first store and at the second store.

11. The system of claim 10 further comprising a communications module for communicating through the first firewall, wherein the first firewall is positioned between a trusted network and the Internet.

21. A system comprising:

first means for generating first examination results from first version information which indicates whether a first workspace element stored at a first store within a firewall has been modified;

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second means for generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store *on a smart phone* outside the firewall;

means for updating the first version information whenever the first workspace element is modified or updating the second version information whenever the copy is modified;

means for initiating the first and second means from within the firewall when predetermined criteria have been satisfied;

means for generating a preferred version from the first workspace element and from the copy based on the first and second examination results; and

means for storing the preferred version at the first store and at the second store.

22. A computer-readable storage medium storing program code for causing a computer-based system to perform the steps of:

(a) generating first examination results from first version information which indicates whether a first workspace element stored at a first store within a firewall *positioned between a trusted network and the Internet* has been modified;

(b) generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store *on a smart phone* outside the firewall;

(c) initiating steps (a) and (b) from within the firewall *through an Internet communications channel* when predetermined criteria have been satisfied;

(d) generating a preferred version from the first workspace element and from the copy based on the first and second examination results, *wherein if only one of the first workspace element and the copy has been modified, then selecting the one as the preferred version*; and

(e) storing the preferred version at the first store and at the second store.

23. A computer-based method comprising the steps of:

(a) *establishing a secure communications channel through a firewall using an HTTP port or an SSL port*;

(b) generating first examination results from first version information which indicates whether a first workspace element stored at a first store within [a] the firewall has been modified;

(c) *before generating the first examination results, the step of updating the first version information whenever the first workspace element is modified*;

([b]d) generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace

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element has been modified, the copy being stored at a second store outside the firewall;

([c]e) initiating steps ([a]b) and ([b]d) from within the firewall when predetermined criteria have been satisfied;

([d]f) determining based on the first and second examination results that both the first workspace element and the copy have been modified; and

([e]g) storing both the first workspace element and the copy at the first store and at the second store, *wherein the second store comprises a smart phone*.

24. A system comprising:

first means for generating first examination results from first version information which indicates whether a first workspace element stored at a first store within a firewall has been modified;

second means for generating second examination results from second version information which indicates whether an independently-modifiable copy of the first workspace element has been modified, the copy being stored at a second store outside the firewall;

means for updating the first version information whenever the first workspace element is modified or updating the second version information whenever the copy is modified;

means for initiating the first and second means from within the firewall when predetermined criteria have been satisfied;

means for determining based on the first and second examination results that both the first workspace element and the copy have been modified; and

means for storing both the first [file] workspace element and the copy at the first store and at the second store, *wherein the second store comprises a smart phone*.

25. A system comprising:

a global server for operating outside a firewall and including memory for storing first workspace data and corresponding first version information; and

a synchronization agent for managing the first workspace data and the corresponding first version information and for communicating with remote clients; [and]

means for updating the first version information whenever the first workspace element is modified;

a remote client for operating within the firewall and including memory for storing second workspace data and corresponding second version information;

means for cooperating with the synchronization agent to synchronize the first workspace data with the second workspace data by examining the first version information and the second version information; and

a synchronization-start module for initiating workspace data synchronization between the global server and the remote client.

* * * * *